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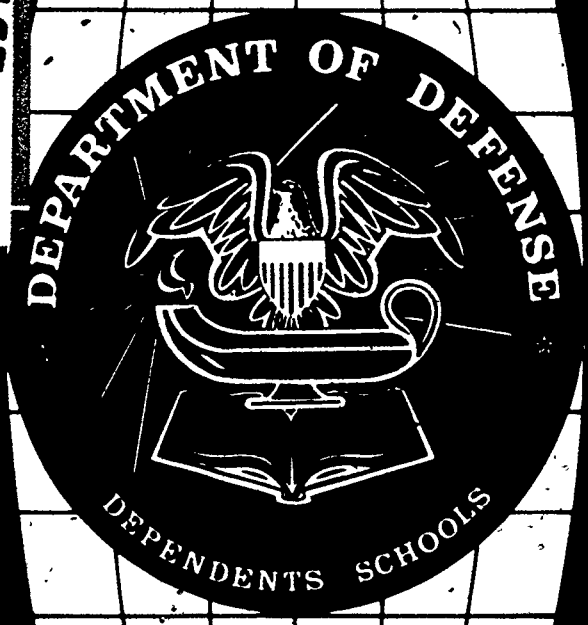
ABSTRACT

This manual provides program objectives for instructors teaching electricity and electronics courses in junior and senior high Department of Defense Dependents Schools. The manual begins with a description of the electricity/electronics courses offered in the Dependents Schools. Following is the main part of the document, consisting of two general objectives: (1) to demonstrate an understanding of the basic concepts and skills in electricity and electronics, and (2) to demonstrate an understanding of the basic concepts related to computers. For each of these objectives, program objectives and suggested instructional objectives are provided, correlated with grade level and electronics or electricity courses. The final section of the manual is an illustrated layout of suggested facilities for the electricity/electronics laboratory. Appended to the manual is a list of approved textbooks for the electricity/electronics curriculum, along with publishers' and authors' names, sources of materials, and names of the textbook review committees. (KC)

Electr



DEPARTMENT OF DEFENSE
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Foreword

Electricity and Electronics in the Department of Defense Dependents Schools (DoDDS) is a career education discipline which provides opportunities for students in junior high and high schools. Approximately 21 schools offer Electricity and Electronics Programs.

The exploratory Electricity and Electronics Program affords junior high students motivational and manipulative experiences to arouse interest and curiosity as a potential career area. A variety of learning experiences are presented to the student.

The high school program also affords the students exploratory experiences as well as industrial, technical and consumer skills. The students learn through hands-on learning experiences, problem solving, and use of tools and test equipment.

This manual has been prepared to provide instructors with the DoDDS Electricity and Electronics Program Objectives.

Anthony Cardinale
Director

Acknowledgments

The objectives in this manual evolved from the efforts of many DoDDS educators

The following personnel worked on committees developing the electricity/electronics objectives

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Introduction

The electricity and electronics program provides the information and experience necessary for the student to build a foundation of knowledge required to understand and apply electricity and electronics to practical situations. Emphasis is placed upon the student as a learner who can develop specific knowledge and skills in understanding the use of electricity and electronics.

The Electricity/Electronics Program considers the needs, capabilities, background, and interests of each student enrolled. Instruction is, therefore, individualized to the greatest extent possible, considering the time and resources available. The routine classroom lecture should be reduced in its role as the primary teaching method. It should be used merely to introduce broad areas and should permit the students to discover details in small groups or on their own. Individualized learning depends heavily upon self-instructional materials, audiovisual learning aids, and student assistants.

To operate successfully, the learning environment must be free and open, but well-ordered and managed with specific objectives in mind. Given such an environment, each student enters at his or her own level of achievement and moves along at his or her own rate of speed. A contract system may be used to monitor and improve upon the achievement rate. Progress is measured against individual performance rather than against that of the class as a whole. This allows students of all ability ranges to be in the same class. Students can move ahead freely and explore enrichment quests. On the other hand, some students that might have been discouraged by failures are not threatened. Students begin wherever they are academically and attitudinally, immediately receiving positive experiences which encourage them to progress.

The role of instructor becomes one of learning facilitator. The instructor prescribes the framework and procedures whereby the learner can accomplish the terminal performance objectives which will be consistent with the entry-level requirements for the career goal.

Description of Electricity/Electronics Course of Study

Junior High School
7-8
EXPLORATORY PROGRAM

The 7-8 grade electricity/electronics course is a 9-week or one-semester exploratory program that affords the student hands-on experience and discerning activities. The course is also designed to motivate students toward further interest in the field of electricity and electronics.

High School
9-12
Electricity/Electronics
EXPLORATORY PROGRAM

The 9-12 grade electricity/electronics exploratory course is a one-semester or longer course, depending upon the student's interest and abilities. The course provides an overview introduction by exploratory hands-on activities in basic electricity and electronics.

High School
9-12
ELECTRICITY

The course of study is one semester or longer, which includes principles of electricity, electrical wiring, lighting and alarm systems, industrial control systems, and electrical motor theory and maintenance.

High School
9-12
ELECTRONICS

The course of study is one semester or longer, which includes elements of electronics, fundamental transistor understandings and applications, integrated circuits, AM-FM receiver systems, telelvision operation, and digital computer techniques and micro-processing.

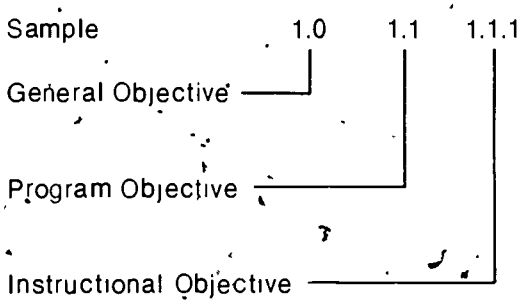
COURSES OF STUDY IN THE SCHOOLS

The courses of study will vary in length and structure throughout DoDDS. The circumstances of location, population, and facilities unique to DoDDS enable each school to have flexibility in offering Electricity/Electronics courses. However, basic elements of curriculum content will remain standard throughout DoDDS. The *program objectives* described in the following pages are considered to be basic elements of the DoDDS curriculum.

Basic textbooks and essential material (software and hardware) have been purchased in 1980 with DoDDS implementation funds for all schools identified offering Electricity/Electronics programs.

Numbering code used with objectives.

- The numbering code indicates the level of the objective.
- The first digit of the number of each statement refers to the general objective.
- The second digit refers to the program objective.
- The third digit identifies the instructional objective.
- Instructional objectives are not to be considered inclusive but only presented as examples.
- The X next to the instructional objective indicates the course in which the objective should be taught.



The number code is used to facilitate

- identification of objectives
- correlation of objectives with textbook and instructional materials
- matching of test items to objectives

All Program and Instructional objectives should be preceeded by the phrase, "The learner should . . ."

General Objective: 1.0 Demonstrate an understanding of the basic concepts and skills in electricity and electronics.

Program Objective	Instructional Objective (Illustrative)	Junior High 7-8	E/E High School Explor-atory 9-12	Elec-tricity High School 9-12	Elec-tronics High School 9-12
1.1 Apply basic concepts and skills in electricity.	1.1.1 Apply safety rules applicable to electrical equipment.	X	X	X	X
	1.1.2 Identify basic handtools and equipment used in electricity.	X	X	X	
	1.1.3 Construct circuits showing the applications of trans-ducers.	X	X	X	
	1.1.4 Identify the applications and efficient use of the various forms of energy.	X	X	X	

Program Objective	Instructional Objective (Illustrative)	Junior High 7-8	E/E High School Exploratory 9-12	Electricity High School 9-12	Electronics High School 9-12
1.1 (Continued) Apply basic concepts and skills in electricity.	1.1.5 Define basic logic circuits and their applications.	X	X	X	
	1.1.6 Analyze basic electrical components and their schematic diagrams.	X	X	X	
	1.1.7 Identify electrical components and their schematic diagrams.	X	X	X	
	1.1.8 Construct electrical circuits from schematic diagrams and make measurements necessary to mathematically analyze the circuit.	X	X	X	
	1.1.9 Describe ways in which electrical energy can be changed into other forms of energy.	X	X	X	
	1.1.10 Test basic motor control circuits.		X	X	
1.2 Apply the concepts related to electrical wiring.	1.2.1 Identify tools and equipment used in the electrical trades.		X	X	
	1.2.2 Interpret electrical schematic diagrams in the wiring of high and low voltage devices.		X	X	
	1.2.3 Identify faulty electrical circuits.		X	X	
	1.2.4 Repair faulty electrical circuits.		X	X	
	1.2.5 Compute electrical energy costs.		X	X	
	1.2.6 Identify ways of conserving electrical energy.		X	X	
	1.2.7 Identify safe practices for working with electrical equipment.		X	X	
1.3 Apply basic concepts related to lighting and alarm systems.	1.3.1 Perform wiring activities dealing with commercial and residential wiring, sign display wiring, burglar and fire protection alarms, and fixture and receptacle planning.		X	X	

Program Objective	Instructional Objective (Illustrative)	Junior High 7-8	E/E High School Explor-atory 9-12	Elec-tricity High School 9-12	Elec-tronics High School 9-12
	1.3.2 Demonstrate the proper methods of electrical assembly.		X	X	
1.4 Apply concepts related to industrial control systems.	1.4.1 Identify components of industrial control systems and schematic diagrams.		X	X	
	1.4.2 Interpret schematic diagrams in setting up experiments using the components of industrial control systems.		X	X	
	1.4.3 List the advantages of electrical/mechanical and solid state control devices.		X	X	X
	1.4.4 Construct industrial control systems.		X	X	X
	1.4.5 Use proper test equipment for troubleshooting the circuits.		X	X	
1.5 Apply concepts related to electrical motor theory and maintenance.	1.5.1 List the different types of motors and how they are used.		X	X	
	1.5.2 Use proper skills in motor maintenance, wiring connections, current measurement, testing, and troubleshooting.		X	X	
1.6 Apply basic concepts and skills in electronics.	1.6.1 Construct circuits showing the applications of active and passive devices, such as transistors, diodes, and capacitors.	X	X	X	X
	1.6.2 Identify factors used in the selection, purchase, use, and maintenance of the products of the electrical/electronic industry.	X	X	X	X
	1.6.3 Use safety rules applicable to electronic equipment.	X	X	X	X
	1.6.4 Identify all common electronic components, their symbols, and electronic circuits.		X		X

Program Objective	Instructional Objective (Illustrative)	Junior High 7-8	E/E High School Exploratory 9-12	Electricity High School 9-12	Electronics High School 9-12
1.6 (Continued) Apply basic concepts and skills in electronics.	1.6.5 Solve practice problems concerning laboratory measurements.	X			X
	1.6.6 Interpret simple schematic diagrams and written procedures in setting up and troubleshooting basic electronic circuits.				X
	1.6.7 Operate various types of laboratory test equipment and tools needed for repairing electronic systems.				X
	1.6.8 Select proper soldering equipment and techniques in soldering electronic components.				X
1.7 Apply the concepts related to fundamental solid state electronics.	1.7.1 Identify various solid state circuits, their symbols, and electronic specifications.			X	X
	1.7.2 Calculate gains, load lines, output power, and quiescent operating parameters.				X
	1.7.3 Operate test equipment to measure all parameters in a functioning circuit.				X
1.8 Apply the concepts related to transistor circuits.	1.8.1 Identify solid state oscillators, amplifiers, regulators, and power supply circuits.				X
	1.8.2 Construct solid state oscillators, amplifiers, regulators, and power supply circuits.				X
	1.8.3 Test solid state oscillators, amplifiers, regulators, and power supply circuits.				X
1.9 Apply the concepts related to integrated circuits.	1.9.1 Conduct experiments using linear integrated circuits.				X
	1.9.2 Draw circuits using linear integrated circuits in their various applications.				X

Program Objective	Instructional Objective (Illustrative)	Junior High 7-8	E/E High School Explor-atory 9-12	Elec-tricity High School 9-12	Elec-tronics High School 9-12
	1.9.3 Test linear integrated circuits using schematics and test equipment.				X
1.10 Apply the concepts related to AM receiver systems.	1.10.1 Define the operation of circuits in an AM system.				X
	1.10.2 Interpret schematics in analyzing AM receivers for repairing and testing.				X
	1.10.3 Align an AM receiver.				X
	1.10.4 Select the proper sequential steps in diagnosing and troubleshooting an AM receiver.				X
	1.10.5 Demonstrate proper methods of assembly.				X
1.11 Apply the concepts related to FM receiver systems.	1.11.1 Define the operation of circuits in an FM system.				X
	1.11.2 Interpret schematics in analyzing FM receivers for repairing and testing.				X
	1.11.3 Align an FM receiver.				X
	1.11.4 Select the proper sequential steps in diagnosing and troubleshooting an FM receiver.				X
	1.11.5 Demonstrate proper methods of assembly.				X
1.12 Apply the concepts related to television operation.	1.12.1 Describe the shock hazards involved with high voltage inside a TV receiver.				X
	1.12.2 Define the operation of the circuits of a TV receiver.				X
	1.12.3 Demonstrate proper use of test equipment to analyze the various waveforms for each section of a TV receiver.				X

Program Objective	Instructional Objective (Illustrative)	Junior High 7-8	E/E High School Exploratory 9-12	Electricity High School 9-12	Electronics High School 9-12
1.12 (continued) Apply the concepts related to television operation.	1.12.4 Select the proper sequential steps in diagnosing and troubleshooting a TV receiver.				X
	1.12.5 Interpret schematics in analyzing TV receivers for repairing and testing.				X
General Objective: 2.0 Demonstrate an understanding of the basic concepts related to computers.					
2.1 Apply the basic concepts related to digital computer techniques.	2.1.1 Perform experiments using digital integrated circuits.				X
	2.1.2 Use Boolean algebra to assist in the design of digital circuits.				X
	2.1.3 Identify methods of utilizing combinational logic circuits to obtain a desired result.				X
	2.1.4 Summarize the impact that integrated digital circuits has had on consumer products.				X
	2.1.5 Evaluate the proper operation of digital circuits using the appropriate test equipment.				X
2.2. Apply the basic concepts related to computer microprocessing	2.2.1 Conduct experiments in computer arithmetic and programming, using a microprocessor.				X
	2.2.2 Build circuits used to interface microprocessors with peripheral devices.				X
	2.2.3 Demonstrate proper use of test equipment to determine the proper operation of microprocessor systems.				X

Suggested Facilities Layouts

The facilities descriptions and layout sketches following are intended only as guides. Any number of alternative facility plans could work equally well. For some schools, facilities for this program may already exist. In such cases, the following material may offer the instructor and administration some suggestions for making the facility more effective through minor alterations.

For other schools starting up a new program, it may be necessary to remodel existing facilities. In such cases, it should not be expected that the remodeled facilities will offer every advantage that can be achieved with new facilities.

Even if new facilities are to be provided, a school may be unable to support a complete laboratory either because of enrollment, space, staff, or financial limitations. In such cases, decisions must be made regarding minimum program essentials and then facilities designed to fit.

Whether new or remodeled, facilities may serve multiple or joint functions. Thus, business and graphic production areas may be combined, art and graphics study areas could be shared, welding can be done in an auto shop, small engine and automotive shops can be combined, computer and business programs may share spaces, the various health and cosmetology programs can share a common suite, and the electronics laboratory could be combined with a physical science laboratory.

Such combinations have served elsewhere to strengthen both programs. Students see the direct relationship of what they are doing with careers in another field, and faculty finds professional stimulation and mutual support in working with colleagues in what have often been artificially separated disciplines.

Electronics/Electricity Laboratory

The electronics laboratory will house vocational courses in basic electronic theory and practice that will provide basic entry-level skills in the radio, TV, small appliance repair, and electronics career areas.

The total area of approximately 1,400 square feet should be subdivided into a general laboratory area, project storage (250 sq. ft.), and equipment storage (150 sq. ft.)—see functional zone sketch.

The project and equipment storage areas must provide secure storage. There should be adjustable shelving, 18 inches deep from floor to ceiling on all available wall space.

There should be two wood-top electronics work benches on the walls at the ends of benches. Students will stand when working at these benches. Benches should be 24 inches deep and should have closed storage underneath.

The general laboratory area should have 110 and 220 volt electrical outlets on 8-foot centers on all walls and in the center of the room. An under-floor grid system with relocatable outlet boxes is acceptable for floor-level service. There should be two master cut-off

switches controlling all receptacles. One master switch should be located near the corridor door and one near the door leading to the teacher's office.

The general laboratory area should have a chalkboard, tack board, and sink with hot and cold water.

A lead-in from an outside television antenna should be provided on one work bench wall.

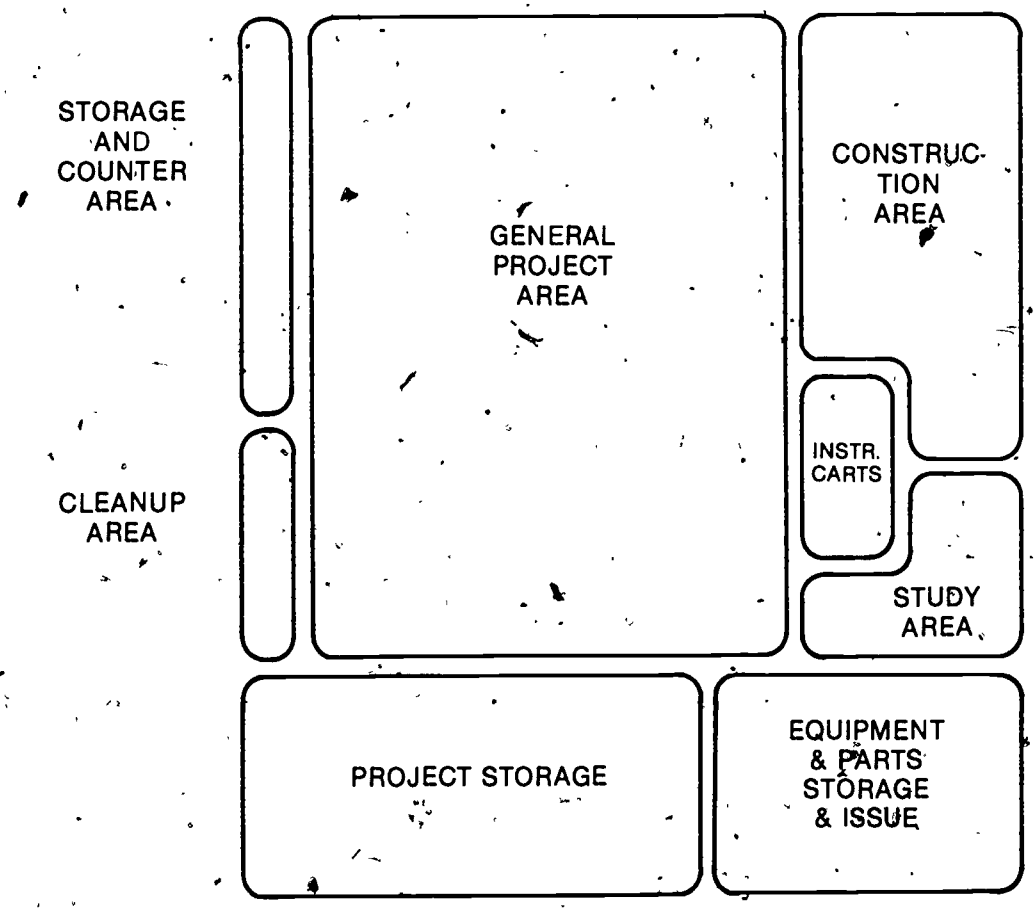
Illumination should provide a minimum of 50 foot candles at desk-top height.

The laboratory should be capable of darkening for the use of visual aids.

In the building that houses the electronics laboratory there should be provision for access to the roof where antennas will be installed for TV and radio reception, which will service the electronics laboratory. Antennas will be required for the equipment used. Students will install and service antennas.

The floor should have an insulation barrier over concrete to prevent grounding.

Suggested Electricity/Electronics Laboratory Functional Zones*



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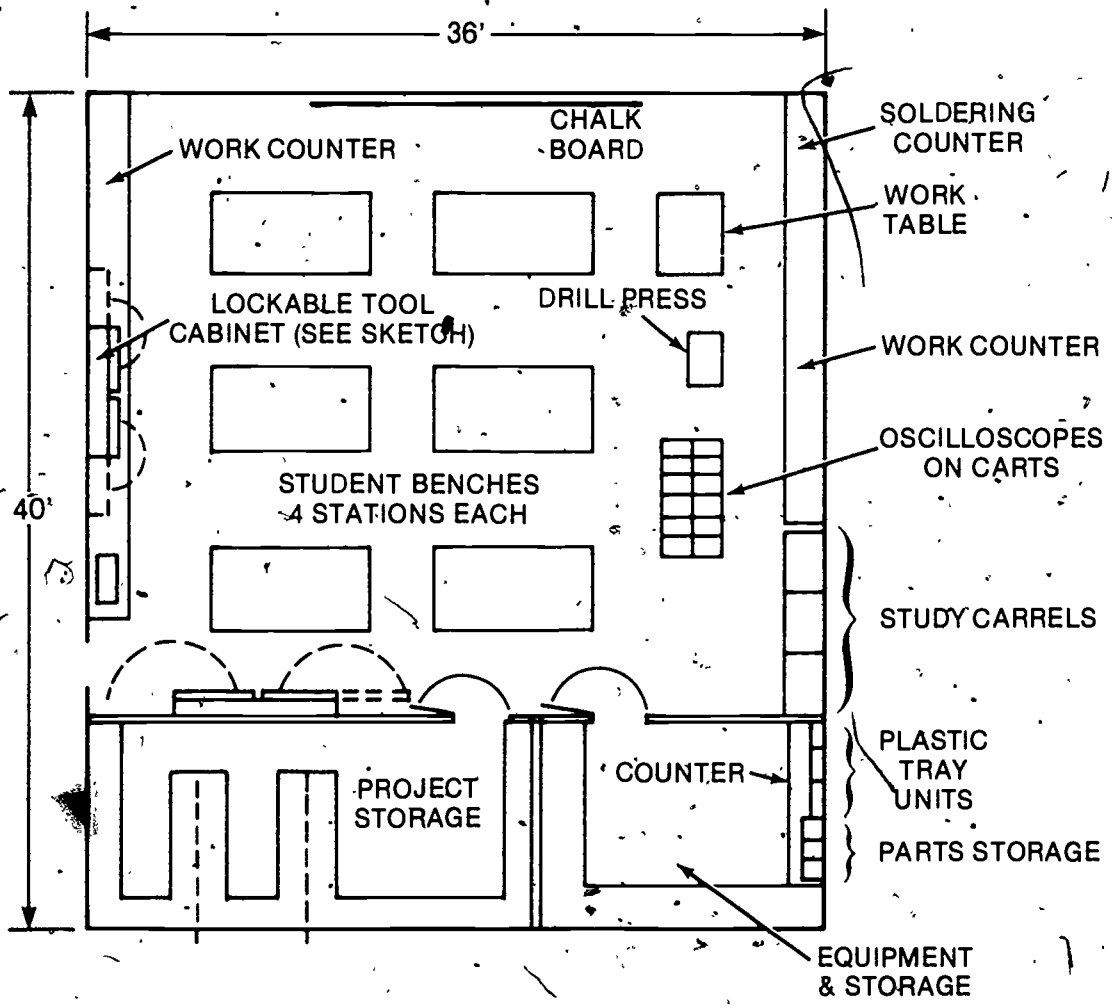
Suggested Electricity/Electronics Laboratory*



NOTE: BENCH SIZE MAY BE CUT FROM 8' X 48" TO 8' X 39" TO GAIN ADDITIONAL FLOOR SPACE IF DESIRED.

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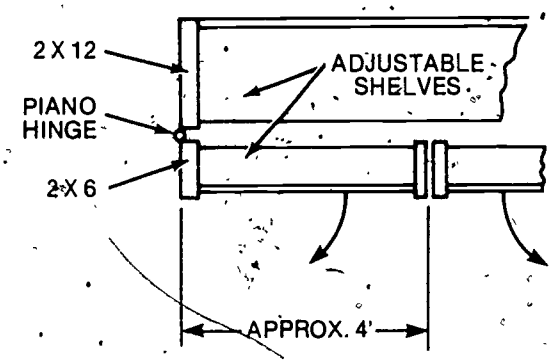
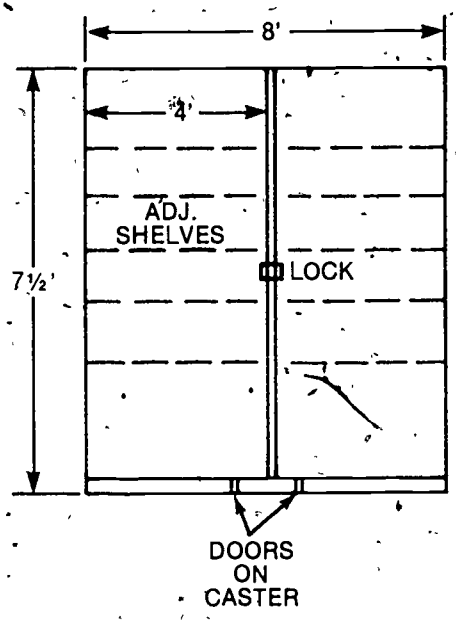
Suggested Cabinet Detail *
Electricity/Electronics Laboratory

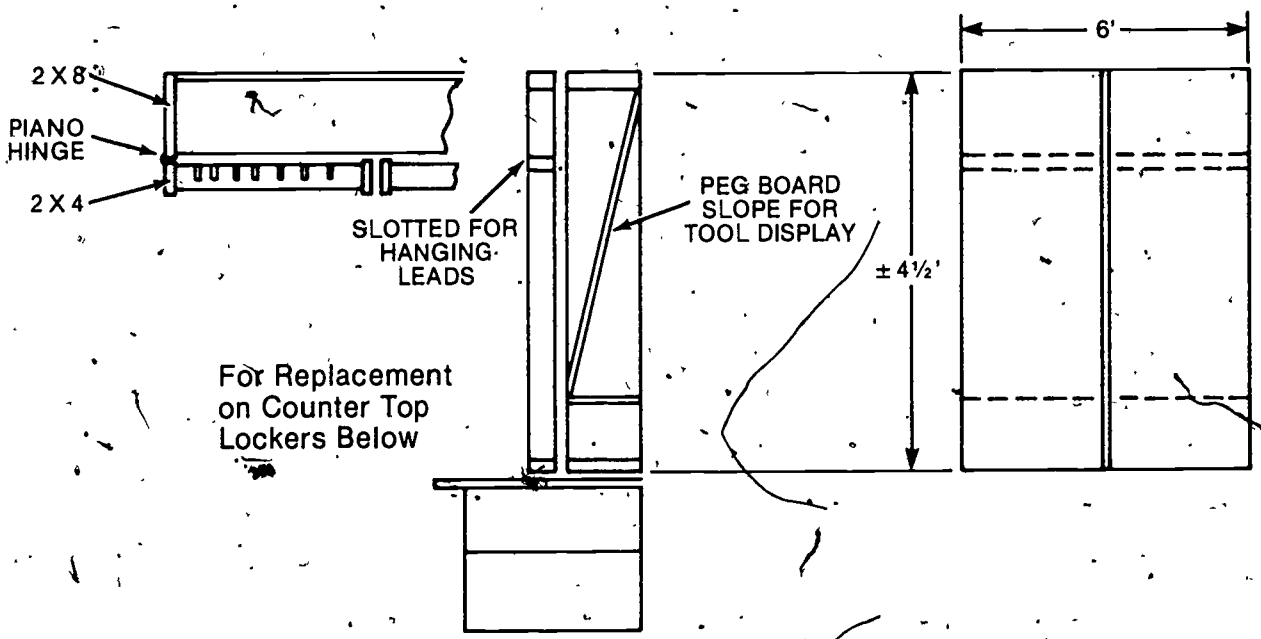
Lockable Equipment Cabinet





For Secure Storage of:
- Meters
- Signal Generators
- Power Supplies
- Similar Equip.

Lockable Tool Cabinet



For Replacement on Counter Top Lockers Below

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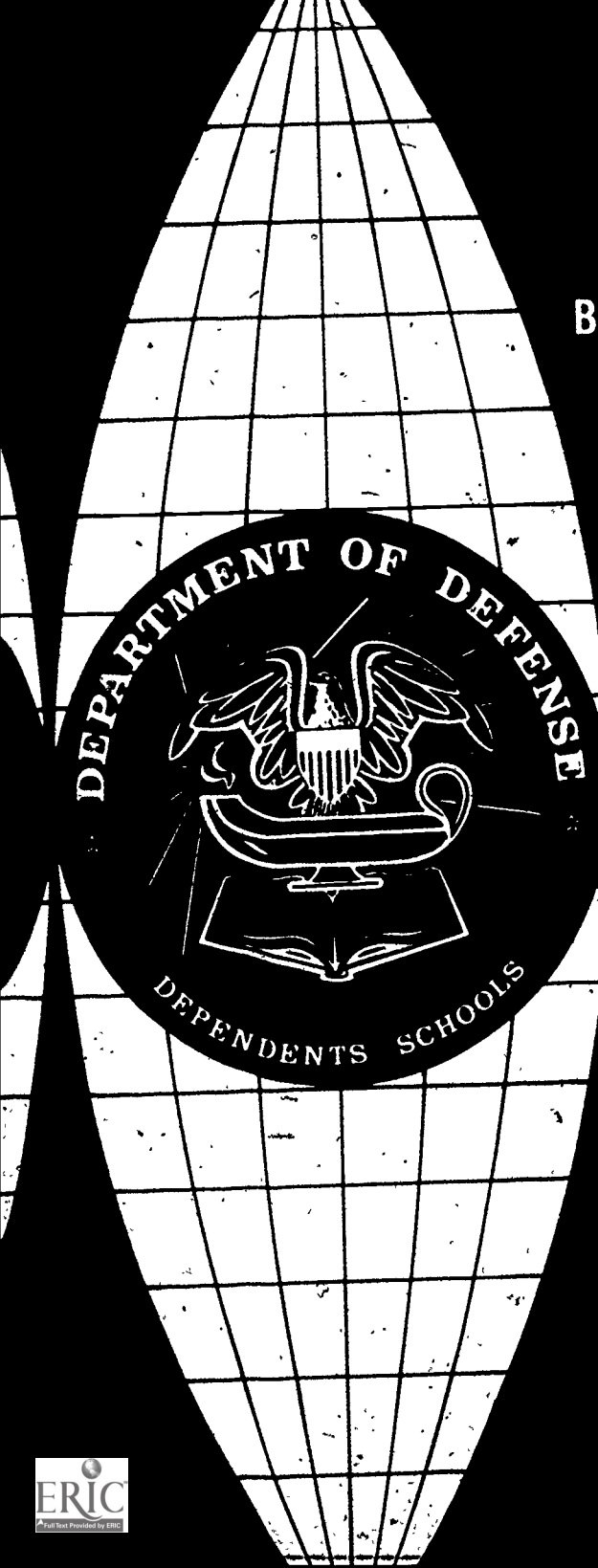
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DEPARTMENT OF DEFENSE
OFFICE OF DEPENDENTS SCHOOLS
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331

EDS-50867

November 15, 1980

MEMORANDUM FOR Regional Directors of Dependents Schools

SUBJECT: Basic Textbooks and Instructional Materials for Electricity/Electronics

It is a pleasure to provide you with the attached Department of Defense Dependents Schools (DoDDS) List of Approved Textbooks and Instructional Materials for Automotive Technology. Any future appropriated fund procurement of Automotive Technology Basic Textbooks and Instructional Materials for DoDDS must conform to this listing until officially revised.

As you know, texts and materials provided by publishers for this review process were studied extensively during school year 1979-80 by formal review committees in the DoDDS regions. Those worldwide committees were composed of students, parents, and community representatives as well as professional educators. Detailed data conforming to established criteria and generated by each of these committees, were reviewed in detail by the Career Education task group in their meeting of June 23-27, 1980. Basic textbooks and instructional materials judged most suitable for achieving the published DoDDS objectives within the DoDDS system have been included in the approval list.

Your support of the DoDDS Electricity/Electronics basic textbooks and instructional materials review is appreciated.

Anthony Cardinale

Anthony Cardinale
Director

Approved List of DoDDS Basic Textbooks and Instructional Materials for Electricity/Electronics - Grades 7-12

TITLE	PRIMARY GRADES	AUTHOR	PUBLISHER	COPYRIGHT DATE
Exploratory				
Exploring Electricity/Electronics with the Electrical Team Research Manual Instructor's Guide	7-8	Rollain Kraus	Delmar-Litton	1979
Electricity: Principles and Applications Activity Manual Teacher's Manual	9-12	Fowler	Gregg/McGraw-Hill International Book Company, Inc.	1979
Electronics: Principles and Applications Activity Manual Teacher's Manual	9-12	Schuler	Gregg/McGraw-Hill International Book Company, Inc.	1979
Television Symptom Diagnosis	9-12	Tinnell	Bobbs-Merrill	1977

SYSTEMS/MODULES
GRADES - 7-12

Instructional Systems offered by Buck Engineering Company, (LAB-VOLT), have been approved for the electricity/electronics laboratories in DoDDS.	LAB-VOLT Systems/Buck Engineering Company, Inc.

Publisher Addresses of Approved Basic Textbooks and Instructional Materials for Electricity/Electronics

Bobbs-Merrill
4300 W 62nd Street
P O Box 7080
Indianapolis, Indiana 60264

LAB-VOLT Systems/Buck
Engineering Company, Inc
P O Box 686
Farmingdale, New Jersey 07727

Litton Ed Publishing
(Delmar and Von Nostrand Rienhold)
135 W. 50th Street
New York, New York 10020

Gregg/McGraw-Hill International
Book Company, Inc
1221 Avenue of the Americas
New York, New York 10020

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